Space Weather Technical Forecast

Issued on Friday 18 October 2024 at 01:12 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Ongoing chance of M-flares. Slight chance of G1/Minor Geomagnetic Storms today (18 Oct).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate, with two M class flares in the period, the largest a M2.4 at 17/0505 UTC from AR3854.

There are currently seven active regions on the visible disc, none of which are especially large but two regions have complex magnetic structures with beta-gamma-delta configurations. Of these one, AR3860, is the most recently numbered region on the disc, in the southeast, and has shown rapid growth through the past 24 hours, although still remains relatively small in size. Out of the remaining five regions on the disc two have moderate magnetic complexity with beta-gamma configurations, and the rest are simple.

No Earth-directed CMEs have been observed in available imagery, although we await further imagery and analysis.

Solar Wind / Geomagnetic Activity: Solar wind speeds were predominantly slightly elevated, generally between 400-450 km/s, although with a period in the middle of the day declining to background levels. Density was initially below average then increased to average levels. The Interplanetary Magnetic Field (IMF), Bt, was weak between 4-7 nT. The Bz component varied weakly throughout, ranging between +6/-6 nT. Phi angle was positive (away from the Sun) throughout. Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 was at background. High energy electron flux (greater than 2MeV) observed by GOES16 was at Background to Moderate with a diurnal peak of 456 pfu at 17/1635 UTC. The associated 24-hour fluence was below the Active threshold, with a gradually decreasing trend. The 18/0000 UTC observation was 1.34e7 total pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is expected with further isolated M-class flares thought likely, given recent activity and the level of magnetic complexity on the disk, with a slight chance of an isolated X-class flare.

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Solar Wind / Geomagnetic Activity: No Earth directed CMEs feature in the forecast. Initial slightly elevated solar winds are expected to decrease to reach background levels today (18 Oct). However, there is the potential for slightly elevated, perhaps elevated winds, to arrive today and persist through days 2 and 3 (19-20 Oct), due to a high speed stream (HSS) from the large coronal hole in the northwest of the disc (CH80/+). Day 4 (21 Oct) winds are expected to gradually decline to background levels to slightly elevated levels.

Overall generally Quiet to Unsettled (Kp 2-3) conditions are expected, with Active (Kp 4) intervals likely and a chance of G1/Minor storms (Kp 5) today (18 Oct) due to the potential arrival of a coronal hole high speed stream.

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 is expected to remain at background, but there remains a slight chance of enhancement toward S1/Minor storm levels. High energy electron flux may temporarily rise to reach high levels at the peaks of the diurnal cycles. However, the associated 24 hour fluence is expected to remain below Active (1e8 total pfu).

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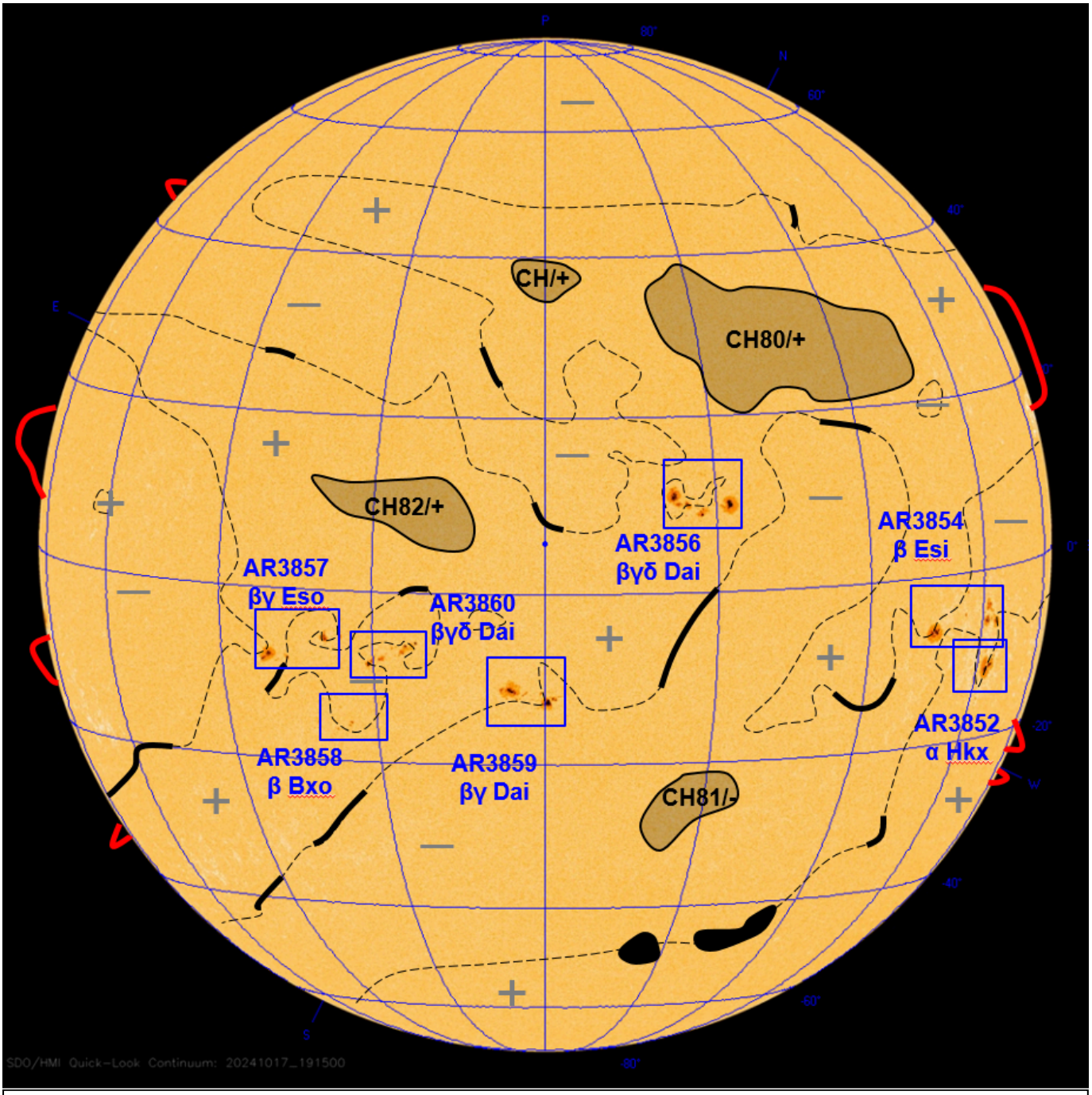
Figure 1: Synoptic map valid 17/1915 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

No Earth directed CMEs currently feature in the forecast. Initial slightly elevated solar winds are expected to decrease to background levels today (18 Oct). However, there is the potential for slightly elevated, perhaps elevated winds, to arrive today and persist through days 2 and 3 (19 and 20 Oct), due to a high speed stream (HSS) from the large coronal hole in the northwest of the disc (CH80/+). This feature is significantly larger and more clearly defined than the previous rotation, therefore recurrence is an ineffective tool. Enhancement from this HSS is estimated to present the risk of winds to slightly-elevated or elevated levels of 450-550km/s, with the risk fading through day 3 (20 Oct).

MOSWOC ENLIL output is thought to be giving generally poor guidance, likely due to recent degradation of GONG-H alpha imagery used to calibrate output for the current features on the viable disk.

Overall generally Quiet to Unsettled (Kp 2-3) conditions are expected, with Active (Kp 4) intervals likely and a chance of G1/Minor storms (Kp 5) today (18 Oct) due to the potential arrival of a coronal hole high speed stream.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	**G1 to G2**	No	30	10	5	1
Strong	**G3**	No	1	1	1	1
Severe	**G4**	No	1	1	1	1
Extreme	**G5**	No	1	1	1	1

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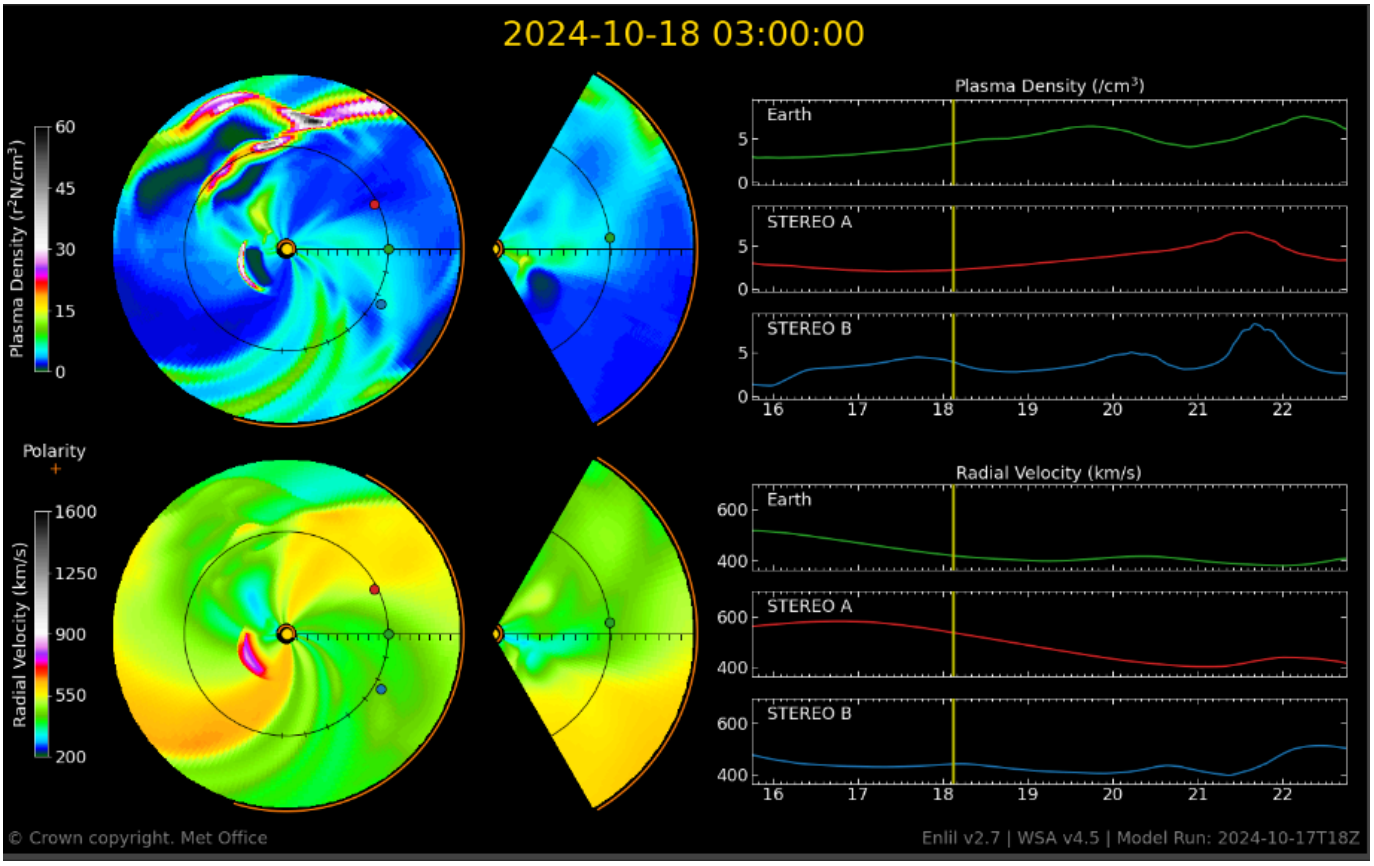
Figure 2:



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Radio Blackouts - X-Ray Flares

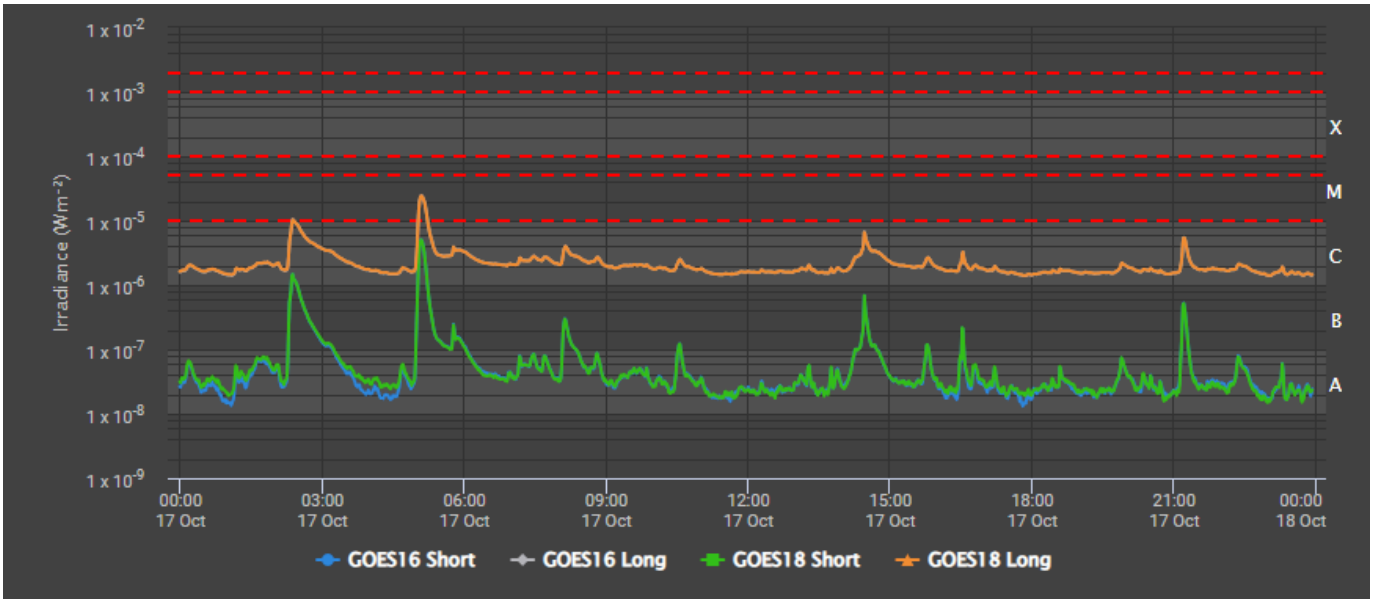
Solar activity has been Moderate, with two R1-class M-flares in the period, the largest a M2.4 at 17/0505 UTC from AR3854.

There are currently seven active regions on the visible disc, including recently numbered AR3860 in the southeast. AR3852 and AR3854 in the southwest quadrant form a coupled pair of sunspots and have shown little change. AR3856 in the northwest near centre disk has recently been stable, but previously increased in both size and complexity with an increasingly complex magnetic structure, and has a very small delta spot in an intermediate spot. The region has also elongated recently. The remaining regions have all shown an increase in either size, complexity or spot number, with the greatest growth occurring in AR3860. This region is now classified as Dai/beta-gamma-delta, having developed a small delta spot within an intermediate spot.

Isolated Moderate flares are thought likely, with a very slight chance of an isolated X-class flare. Currently AR3860 appears to be the most likely region to produce significant flares. New or returning regions are expected to rotate onto the visible disc through the period, maintaining the risk of significant flares while AR3852 and AR3854 rotate off behind the west limb.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	Yes	60	60	55	55
Very Active	R3-R5 (X Class)	No	5	5	5	5

Figure 3: Previous 24 hours GOES X-Ray Flux



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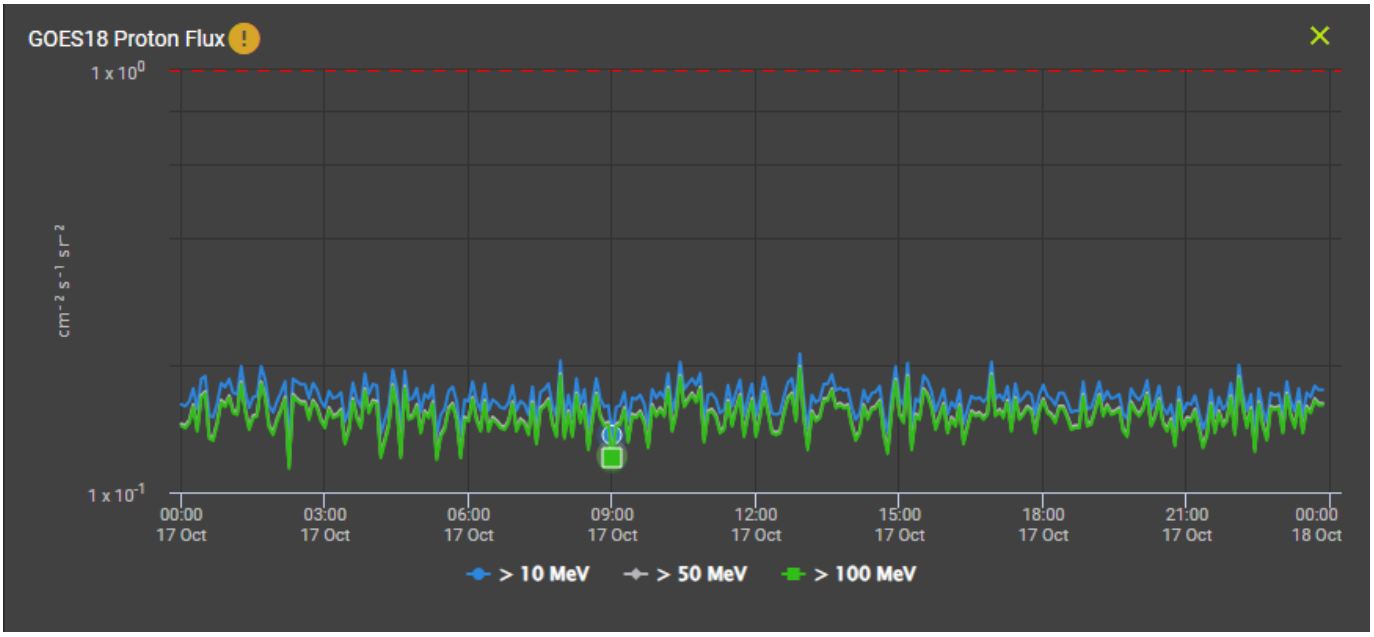
Solar Radiation Storms (High Energy Protons)

High energy proton flux at GOES18 is expected to remain at background, but there remains a very slight chance of enhancement toward S1/Minor storm levels should any notable flares occur, primarily from any of the regions moving across the western hemisphere through the period.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: Last 24 hours GOES 18 Proton Flux



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High Energy Electrons (≥ 2MeV)

High energy electron flux (greater than 2MeV) as observed by GOES-16 have been at background to moderate levels. As solar winds ease to background levels, assuming there is no HSS arrival, the high energy electron flux may rise at GEO to become High at the peaks of the diurnal cycles each day. If the HSS does arrive then the high energy electron flux will be suppressed due to the associated geomagnetic activity.

The associated electron fluence is therefore expected to remain below the Active level (1e8 total pfu), but with a possible rising trend. MOSWOC REFM model output is indicating a steady trend, whereas a slightly increasing trend if preferred, but still the model guidance of keeping the fluence below the Active threshold is accepted.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	10	15	20	20
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

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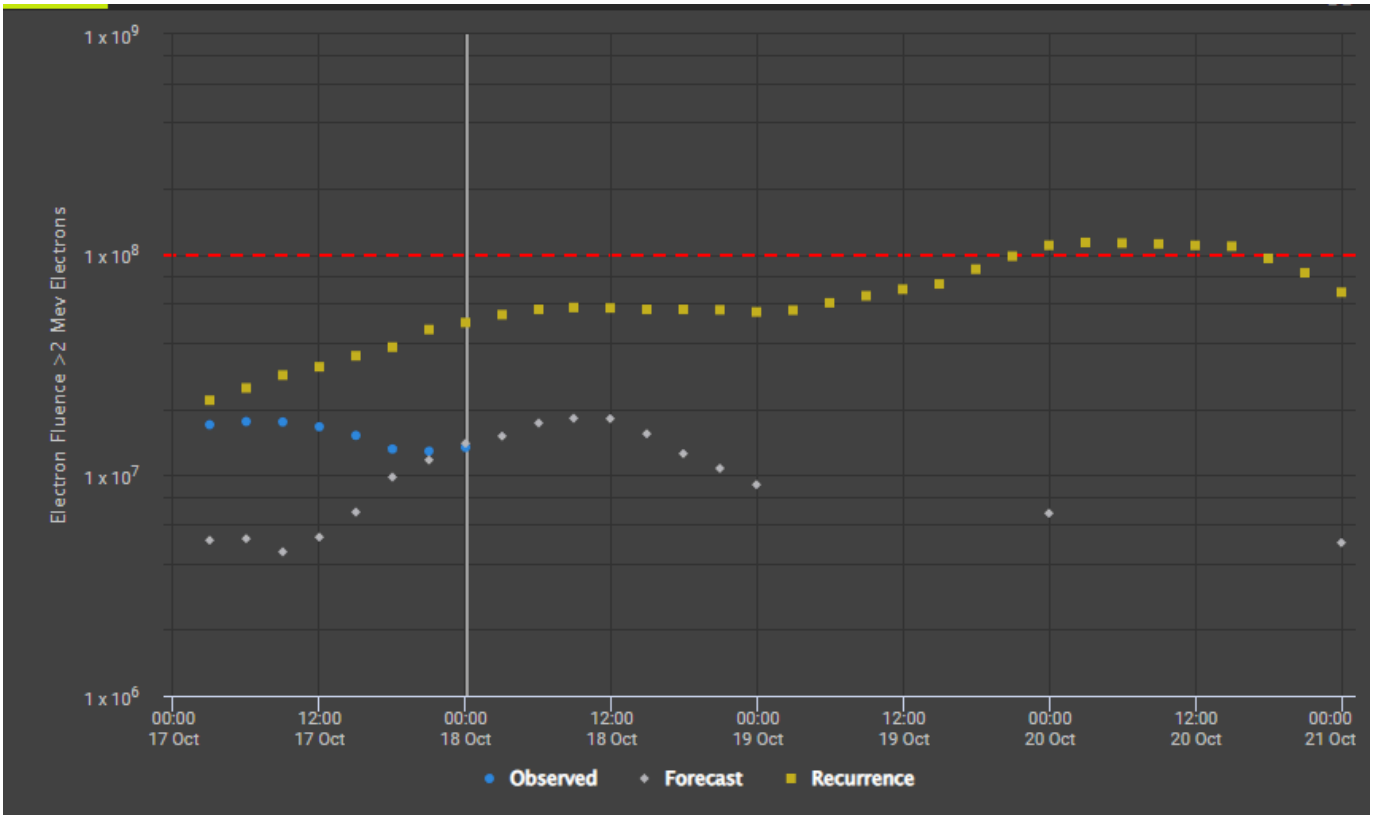
Figure 5: Latest MOSWOC REFM.



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